



# DESIGN AND DEVELOPMENT OF SOLAR BASED MULTI PURPOSE AGRICULTURAL ROBOT

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**Abstract :** Agriculture has been the backbone of the economy and it will continue to remain. Agriculture is the science and art of farming including cultivating the soil, producing crops and raising livestock. Generally, cultivation of any crop involves various steps like ploughing, seed sowing, cutting and water spraying. Farmer has to use various agricultural equipment's and labours for caring out these steps, our purpose is to combine all the individual tools to provide farmers with multipurpose equipment which implements all the scientific farming techniques and specifications, suitable for all type of seed to seed cultivation with minimum cost as possible. This multipurpose agricultural machine is wireless remote operated & designed and fabricated as a multipurpose equipment which is used for agricultural processes. Controlling of the robot mainly require some means of communication. One of the communication means is the wireless Bluetooth connectivity. HC-05 and HC-06 are the Bluetooth modules that are used to control the robot using Smartphone. The Bluetooth application is user friendly and data exchanging between robot and smartphones is done systematically. The developed robot is focused on agricultural purposes like ploughing, seed sowing water spraying and grass cutting. This machine works in both directions when it is pushed forward it ploughs the field with the help of plough. The height of the plough can be adjusted, with the help of screw arrangement. The motor is directly attached to the shaft with holes. When we push the agriculture machine in a backward direction, we can pick the plough up from the ground and the pump which is attached to the front shaft will start pumping the water from the tank and it will sprinkle water over the field.

**IndexTerms -** Agricultural, Multi purpose Robot, ploughing, Seed sowing, Grass cutting, Water spraying

## I. INTRODUCTION

Majority of the Indian people occupation is agriculture. agriculture in India dates back to the Indus valley civilization era, and possibly even earlier in some parts of southern india. More than 40% of the population in the world chooses agriculture as the primary occupation, in recent years the development of the autonomous vehicles in the agriculture has experienced increased interest. India provides second largest output in agricultural field. Indian agriculture is struggling with issues such as availability of skilled laborers, lack of water resources, rising labour costs and crop monitoring. in agriculture, automation technologies are used to solve these issues. automation in agriculture helps farmers to reduce their efforts and increases the yield, which in turn increases the net profit. the vehicles are being developed independently for the processes such as ploughing, Grass cutting, Seed sowing and water spraying. The paper aims on the design, development and the fabrication of the robot which can dig the soil, put the seeds, sprayer to spray water and grass cutting, these whole systems of the robot works with the battery and the solar power. Developing a single machine that can do all these mechanism will help out farmers. in this project, a robot is developed an efficient way to perform the functions autonomously. The proposed plan is to implement the robot to perform the functions such as ploughing, seed sowing, Grass cutting, and water spraying is also performed through web page.

## II. SYSTEM OVERVIEW OF MULTIPURPOSE AGRICULTURAL ROBOT

The block diagram of the proposed system is shown in the Fig 1. It consists of NodeMCU, Solar Panel, Charging circuit, L293N Motor driver, Bluetooth. Robot is powered by battery. Battery is connected to solar panel which is used to charge the battery with the help of solar energy. The battery charge will be maintained in such a way that the battery should charge by solar power and also should discharge for the specific operation simultaneously by using charging circuit.

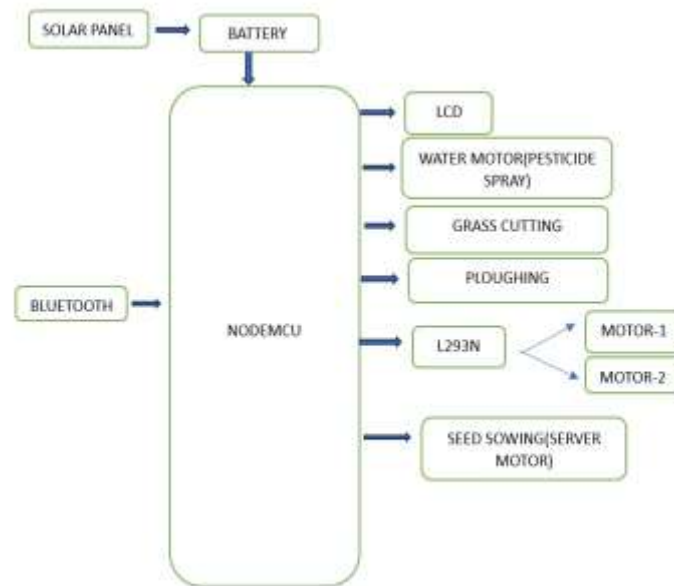


Fig 1 : Block Diagram of multipurpose agricultural robot

In [1], the robot is powered by a solar panel and controlled by a Bluetooth / Android app, which sends signals to the robot to control the necessary mechanisms and movements. Sunlight is converted to electricity and fed into the charging circuit when the solar panel is heated. The HC-05 Bluetooth module is used to send and receive signals from the microcontroller. The app sends signals to the robot, which waits for the appropriate processes to be activated when the signal is received.

In [2], the automatic spraying device consist of single spray nozzle with an automatically. This aims to spray the water to crops.

A four-wheel-drive robot is designed to sow seeds in ploughed agricultural area. In [3] shows how system avoids human work by tracing the path and spreading seeds at equal intervals using the user-specified field area parameters (length and width) and seed spacing intervals as inputs.

The system in [4], aims to develop a multipurpose autonomous agricultural robotic vehicle for ploughing, sowing, and irrigation that can be controlled via Bluetooth. A multipurpose agricultural robot is used to control three functions: Ploughing, seed sowing, Grass cutting and water spraying. Ploughing, sowing, cutting, and water spraying are among the operations provided by the system. The cultivator's direction can be controlled using a Bluetooth app on a smart phone.

The method that sprinkles by an automation bot, which reduces the human effort described in [5]. In our proposed method, the bot is controlled by a blue-tooth module from a mobile phone. Where the mobile phone sends a signal to the micro-controller and the bot responds by spraying.

Many research gaps relating to Agriculture robots have been explored based on the previously published articles [6 to 8]. Other research gaps could also be found such as live video broadcasting of agricultural fields and detecting soil nutrition levels. Ploughing, seed sowing, grass cutting, fruit plucking and pesticide spraying are all displayed indecently. However none of the systems have incorporated in all tasks. The goal of this project is to combine all operations into single robot and develop a versatile robot that must be efficient and effective.

### III. STEPS FOR ROBOT CONTROL

The following commands describes the workflow of the Robot. Sending commands from Arduino Blue Control app through Bluetooth connection between mobile to micro controller (i.e. Node MCU). By using these, command we can control the solar based Multipurpose Agricultural Robot.

Here we used 11 types of commands. They are

- Numerical 1 command for Forward direction
- Numerical 2 command for Backward direction
- Numerical 3 command for Left direction
- Numerical 4 command for Right direction
- Numerical 5 command for Stop the movement of Robot
- Numerical 6 command for Seed sowing on operation
- Numerical 7 command for Seed sowing off operation
- Numerical 8 command for Water on operation
- Numerical 9 command for Water off operation
- Special character \* command for Grass cutting on operation
- Special character # command for Grass cutting off operation

#### IV. RESULTS AND DISCUSSION

Agricultural operations such as seed sowing, water spraying, grass cutting, and ploughing are performed using robot. These procedures are accomplished with the help of the web-page through user commands.

The prime purpose of ploughing is to turn over the uppermost soil, bringing fresh nutrients to the surface[5] while burying weeds and crop remains to decay. Trenches cut by the plough are called furrows. In modern use, a ploughed field is normally left to dry and then harrowed before planting. Ploughing and cultivating soil evens the content of the upper 12 to 25 centimeters (5 to 10 in) layer of soil, where most plant feeder roots grow. Fig 2 displays the ploughing operation.



Fig 2: Ploughing

Seed sowing is one of the agricultural procedures used to sow seeds. It is the initial step of cultivation. Before sowing seeds, ploughing operation has to be performed. Seed sowing that is carried out with the use of funnels and a DC motor. By using slider crank mechanism the seed sowing operation is carried out in forming field. It is time-consuming and repetitive process and it done with a 100 RPM (Revolutions per minute) DC motor. It is activated by sending a signal to Node MCU via relay channel. Fig 3 displays the seed sowing operation.



Fig 3: Seed sowing

Grass cutting is an agricultural procedure for cutting grass from fields. A 1000 RPM (Revolutions per Minute) DC motor is used to cut grass on this robot. Fig 4 shows the grass cutting mechanism.



Fig 4: Grass Cutting

This operation is carried out with a 12 V submersible pump, container attached to it. The pesticide and water are stored in a container which also contains submersible pump. The pump is connected to a pipe which is then connected through valves to the micro-sprinkler. The water spraying mechanism is given in Fig 5.



Fig 5. Water spraying

## V. ACKNOWLEDGMENT

A user-friendly agriculture robot can be designed and controlled remotely and automation technology. Perform the multiple tasks at the same time to reduce manual work and increase yield and profit. Solar power will be effectively used which is advantage for farmers in areas where electricity is not sufficiently available.

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